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ABSTRACT

Increased emphasis on science and mathematics education research in Costa Rica since 1973 is reported. The majority of the studies carried out in the past 12 years have been diagnostic studies. General findings are listed, under the headings of certification, supervision, basic skills, teaching methods, attitudes, and curriculum. The diagnostic stage is now considered over, and there is interest in putting into practice and evaluating teaching innovations, and improving in-service teacher preparation. The need for financial support is noted. International Consortium for Concept Learning activities are discussed, with the current project on calculators briefly described. (MNS)

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The University of Costa Rica

School of Education

Research Institute for the Improvement of Costa Rican Education

(IIMEC)

SCIENCE AND MATHEMATICS EDUCATION RESEARCH IN COSTA RICA

Rolando Berty, Ph.D.

Juan M. Esquivel, Ph.D.

Paper presented at the International Symposium for
The Improvement of Education and International Relations
through Cooperative Research
The Ohio State University
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SCIENCE AND MATHEMATICS EDUCATION RESEARCH IN COSTA RICA

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Goals and Directions

Educational research in general and science and mathematics education research in particular have been developed strongly in the last ten years in Costa Rica. In the early seventies, there were very few research studies in science and mathematics education. Those studies represented the interests of isolated scholars or a required thesis for a degree. Since the creation of the Center for the Improvement of Science Education (CEMEC) in 1973 and later the Research Institute for the Improvement of Costa Rican Education (IIMEC) in 1980, the research in these two fields have received increased emphasis.

The majority of the studies carried out in the past twelve years have been diagnostic studies. As examples the following can be pointed out:

1. Solution of arithmetic problems in the ninth grade (Moya, 1972)
2. An evaluation of the learning of some basic mathematics concepts in the Costa Rican elementary school (Bujan, 1974)
3. An evaluation of the learning of some basic mathematics concepts in students of eleventh grade (Vargas, 1975)
4. A study of the relationship between teacher and student perceptions of classroom activities and selected variables (Berty, 1975)
5. Partial evaluation of the program for the improvement of science teaching and analysis of the current situation of science teaching in the elementary school (Castro & Mora, 1979)

6. Science education research needs as perceived by science teachers in Costa Rica (Esquivel, 1980)
7. A study of the relationship between socio-economic characteristics and aspects of mathematical achievement of primary school children of grades four and six in Costa Rica (Bujan, 1980)
8. An evaluative diagnosis of mathematics education in Costa Rica (Esquivel, Peralta, & Delgado, 1983)
9. Development, validation and administration of science CR battery tests (Esquivel & Quesada, 1985)

In general these studies have shown the following:

Certification

1. There are not enough certified mathematics teachers in Costa Rica.
2. In general science and biology there are enough certified teachers.
3. There is a great need for certified Physics and Chemistry teachers.

Supervision

1. The supervision from the Ministry of Education is almost lacking.

Basic Skills

1. The mastery of basic skills in mathematics and science is very low.
2. The achievement measured by CR tests is lower in the higher grades than in the lower grades.
3. There is no mastery of science process skills.

Teaching Methods

1. Science teachers use content as the basis for their teaching.
2. Science classes are teacher-centered.
3. There are few laboratory periods.
4. There is no general use of concrete materials in teaching of mathematics or science at the elementary level.

Attitudes

1. Elementary and secondary school teachers show a positive attitude toward math and sceince and the teaching of these subjects.
2. Youngsters at the elementary and secondary levels show a positive attitude toward math and science, toward the school, and toward the teacher.

Curriculum

1. The national curricula is rigid and consequently does not adjust to the needs of the children in the different regions of the country.
2. Teachers, supervisors, and specialists do not have a clear conception of the philosophical, psychological and pedagogical foundations of science or mathematics curricula.

In the last two years there have been intents to develop other research areas in science and mathematics education. The diagnostic stage is now over and the goal of educational research in math and science is two-folded: first, there is interest to put into practice and evaluate teaching innovations. Second, there is great emphasis on the improvement and evaluation of programs for in-service teacher preparation.

Needs and Resources

Up to this point Costa Rica has developed a fairly good group of science and mathematics education researchers. There are at least three groups of scholars doing research in the country: one at the University of Costa Rica (IIMEC), one at the Ministry of Education (CEMEC), and one at the College of Natural Sceinces at the National University. There is little financial support from the authorities due to the general lack of funds for research and the financial crisis of the country.

In order to have a more effective science and mathematics education research program at the University of Costa Rica (IIMEC) there is need for financial support. The support will permit the acquisition of different materials and up to date technology. This financial support will provide contact with scholars abroad, participation in workshops, seminars or professional meetings, and will help young scholars to pursue graduate studies abroad. The International Consortium for Concept Learning is a good example of the kind of exchange that a strong financial support will let us have.

The International Consortium Activities in Costa Rica

Several benefits have resulted from the participation of the IIMEC in the International Consortium for Concept Learning. First, it has permitted the consolidation of a very fine group of mathematics and science educators.

Second, it provides the opportunity to share experiences with other members of the International Consortium and receive advice in the early stages of the development of a research project. Third, with the help of members of the Consortium, Dr. Arthur L. White and Dr. Donna Berlin, a teacher workshop was held at the University of Costa Rica during the first week of April, 1985. This workshop was on the use of concrete materials and the calculator in elementary mathematics education. Finally, it is expected that continued participation in the effort will be of mutual benefit and that this research project will extend to other areas of science and mathematics education.

The Current Project: "The Use of Calculator Activities in the Transition from Concrete Manipulation of Objects to Abstract Thinking in Elementary School Mathematics."

The National Council of Teachers of Mathematics recommends the integration of calculators and computers into the elementary school mathematics curriculum. This study explores the learning model which suggests that a concept is acquired first through manipulation of concrete objects, followed by transformation of the concrete objects into semi-concrete representations, followed by internalization of the concept through abstract representations.

Two series of calculator activities for teaching elementary school mathematics will be used. One series will be for numeration, the other for place value. These activities will be used to study how children differ in their understanding of mathematics concepts when using the calculator compared to using concrete manipulative materials, or a combination of calculator and concrete materials.

The sample for the study will include a total of 120 children equally distributed according to male and female and 2nd and 4th grade level. The treatment conditions will consist of three levels based upon the proportion of activities using concrete objects to activities using the calculator (concrete only, concrete and calculator, calculator only). The criterion measures will assess the children's ability to: recognize and extend number patterns, understand and apply place value, and recognize and extend geometric patterns.

A multivariate analysis of variance will be used to determine the influence of calculator use on mathematics concept development compared to use of concrete materials. Differential effects will be tested in terms of Gender, Grade Level and Instructional Format.

This resea ch project will be coordinated with research projects in three other countries:

"Microcomputers and the transition from concrete to abstract understanding of elementary school mathematics", Professors Donna F. Berlin and Arthur L. White, The Ohio State University, Columbus, Ohio, U.S.A.

"Microcomputers and the transition form concrete to abstract understanding of elementary science and mathematics", Professor Pamela F. Abder, University of West Indies, St. Augustine, Trinidad and Tobago, West Indies.

"Microcomputers and calculators in the Math Laboratory program." Ms. Pilar Vela, American School, Puebla, Mexico and Professor Edgar Becerra, University of Mexico, Mexico City, Mexico.

References

Berty, R. A study of the relationship between teacher and student perceptions of classroom activities and selected variables. Unpublished doctoral dissertation, The Ohio State University, 1975, Columbus, Ohio.

Berty, R., Esquivel, J., and Bujan, V. Research project: The use of calculator activities on the transition from concrete manipulation of objects to abstract thinking in elementary school mathematics, 1985, IIMEC, University of Costa Rica.

Bujan, V. Una evaluacion del aprendizaje de algunos conceptos matematicos basicos impartidos en la escuela primaria costarricense. "Revista de la Universidad de Costa Rica", 37, 1974.

Bujan, V. A study of the relationship between socioeconomic characteristics and aspects of mathematics achievement of primary school children of grades four and six in Costa Rica. Unpublished doctoral dissertation, The Ohio State University, 1982, Columbus, Ohio.

Castro,G. and Mora, J. Evaluacion parcial del programa para el mejoramiento de la ensenanza de las ciencias (UNESCO-UNICEF-MEP) y Analisis de la situacion actual de la ensenanza de las ciencias en el I y II ciclos de la Educacion General Basica. Tesis de Licenciatura no publicada en Administracion Educativa. Facultad de Educacion, Universidad de Costa Rica, 1979.

Esquivel, J. Science education research needs as perceived by Science teachers in Costa Rica. Paper presented at the Regional Meeting of NSTA, Orlando, Florida November, 20-22, 1980.

Esquivel, J., Peralta, T. and Delgado, V. An evaluative diagnosis of mathematics education in Costa Rica, A final research report, IIMEC, 1983.

Esquivel, J. and Quesada, L. Development, validation, and administration of science CR battery tests. Paper presented at NARST annual meeting, French Licks, Indiana, April 15-18, 1985.

Moya, A. Resolucion de problemas aritmeticos en tercer ano de secondaria (tercer ciclo), Trabajo de investigacion presentado ante la Escuela Normal Superior para optar al titulo de Professor de Estado en la especialidad de Matematicas, 1975.

Vargas, G. Evaluacion del aprendizaje de algunos conceptos matematicos basicos en estudiantes de undecimo ano. Tesis de Licenciatura en Administracion Educativa no publicada. Facultad de Educacion, Universidad de Costa Rica, 1975.